A REDESCRIPTION OF *CHAETOZONE SETOSA* MALMGREN, 1867 INCLUDING A DEFINITION OF THE GENUS, AND A DESCRIPTION OF A NEW SPECIES OF *CHAETOZONE* (POYCHAETA: CIRRATULIDAE) FROM THE NORTHEAST ATLANTIC

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ABSTRACT

Chaetozone setosa Malmgren, 1867 is commonly recorded as present in soft sediments from the intertidal zone to the deep sea from many localities worldwide. The genus was not defined by Malmgren, 1867 in his description of *Chaetozone* n. gen. and *setosa* n. sp. Later authors (Day, 1967; Fauvel, 1927; Hartman, 1961) have attempted definitions using a variety of characters based largely on the occurrence, form and arrangement of the spine-like chaetae. The publication of a new species of *Chaetozone* (Woodham and Chambers, 1994a) highlighted the need for a re-examination of the type species of the genus. Malmgren's type material has been examined and re-described, the genus defined, and a new species described from British waters.

The genus *Chaetozone* was erected for *C. setosa* Malmgren, 1867 but no generic diagnosis was included. Originally described from Spitzbergen, Finland and Sweden, *C. setosa* Malmgren, 1867 has since been recorded from other Arctic localities (Ditlevsen, 1937; Fauvel, 1907; Levinsen, 1883; Wesenburg-Lund, 1950) and other oceans of the world from the eulittoral zone to 4950 m, Hartman and Fauchald (1971) in a variety of substrata. The locality records include the northeast Pacific (Berkeley and Berkeley, 1952; Fauchald, 1972; Hartman, 1961; Pettibone, 1954), northwest Pacific (Uschakov, 1955; Imajima, 1997), southeast Pacific and Antarctic seas (Hartman, 1967), northwest Atlantic (Day, 1973; Hartman, 1965; Webster and Benedict, 1887) east Atlantic (Day, 1967; Kirkegaard, 1959), Gulf of Aden (Monro, 1937), Mediterranean (Fauvel, 1927), Black Sea (Marinov, 1977) as well as numerous localities in the northeast Atlantic and North Sea (Bamber, 1993; Cunningham and Ramage, 1888; Hartmann-Schröder, 1996; Hily, 1987; Kirkegaard, 1969; Lechapt, 1983; McIntosh, 1915; O'Reilly et al, 1997; Southern, 1914; Spärck, 1937). This species has subsequently been considered as cosmopolitan by various authors (Day, 1973; Fauchald, 1972; Hartmann-Schröder, 1971 and 1996; Imajima, 1997; Kirkegaard, 1969). The only other species in the genus, *C. gibber* Woodham and Chambers 1994a, recorded from the north Atlantic, differs from *C. setosa* most noticeably in the presence of eyes and a humpback appearance.

While examining specimens from several localities around the British Isles it became clear that more than one species of *Chaetozone* without eyes was present. Two species that were commonly encountered from a wide range of localities were each characterized by a pointed prostomium, constricted posterior segments, the presence of capillary chaetae and spines with unidentate tips in posterior segments. They differed in the number of segments, arrangement of chaetae and position of the branchiae. Since both species could be assigned to *C. setosa* it became necessary to examine the type material of Malmgren.

Material and Methods

Samples from the British Isles were collected by many people over several years between 1982 and 1998. All samples were fixed in approximately 10% formalin solution and later transferred to approximately 70% alcohol. Specimens were examined using a Wild M7 stereomicroscope and drawings were prepared with the aid of a camera lucida.

Material was obtained from the following institutions; Swedish Museum of Natural History (SMNH); Environment and Resource Technology Ltd (ERT); Scottish Environmental Protection Agency (SEPA). Type material has been deposited in the National Museums of Scotland (NMS); National Museums and Galleries of Wales (NMW); Swedish Museum of Natural History (SMNH).

Systematics

Redescription of *Chaetozone* Malmgren, 1867

Chaetozone Malmgren, 1867: 96, pl. 14, fig. 84; McIntosh, 1915: 263.

Material Examined.—Malmgren's *Chaetozone setosa* material is recorded as 69 lots from various expeditions which include Spitzbergen, Greenland, Novaya Zemyla, and non-expedition localities in north Scandinavia. Examination of specimens from 21 lots revealed the samples to contain several genera and species including *Tharyx* and *Aphelochaeta*. Although numerous, the specimens are mostly incomplete or in poor condition. Very little is known about the fixation or preservation techniques of this collection.

Description.—Prostomium conical, eyes present or absent; peristomium achaetous with a pair of tentacular palps and a pair of simple branchiae; parapodia biramous with reduced lobes and a pair of branchiae on most anterior segments. Chaetae all simple and include fine capillaries of various lengths, sometimes very long capillaries present in notopodia, stout awl-shaped capillaries and spines with unidentate tips present.

Remarks.—The absence of a generic description by Malmgren for *Chaetozone* has led to taxonomic confusion for over a 100 yrs (Woodham and Chambers, 1994b). The apparent uniformity of the bipalpate cirratulids and the poor preservation of important characters such as branchiae and palps has led to few new taxa being described from British waters. There have been various attempts to define the genus *Chaetozone* (Caullery and Mesnil, 1898; Chamberlain, 1919; Day, 1967; Fauvel, 1927; Hartman, 1961; Webster and Benedict, 1887; Wolf,1984) with most authors emphasizing the type and arrangement of the chaetae. Particular attention has been placed on the degree of the intersegmental constrictions and the completeness of the ring of spines on posterior segments. The partial revision of bipalpate genera by Blake (1991) separated *Tharyx* Webster and Benedict, 1887, *Aphelochaeta* Blake, 1991 and *Monticellina* Laubier, 1961 according to the type and arrangement of chaetae. The other genera recorded from the north Atlantic *Caulleriella* Chamberlain, 1919 and *Chaetozone*, were not included in Blake (1991). In Chamberlain's attempt to clarify the classification of cirratulidae he produced a dichotomous key and cited a new genus, *Caulleriella*. However, the new genus was not described but only introduced in a couplet of the dichotomous key, and in a footnote; Chamberlain (1919) designated *Cirratulus viridis* Langerhans, 1880 as the type species. Chamberlain also separated *Caulleriella* from *Chaetozone* on the basis of whether or not acicular chaetae (= spines) formed a complete circle in posterior segments. In *Caulleriella* the spines did

not form a circle whereas in *Chaetozone* they formed a nearly complete circle. In Chamberlain's (1919) key, *Caulleriella* was also separated from *Tharyx* by the presence or absence of acicular chaetae, with *Caulleriella* having unidentate and bidentate spines in both rami and *Tharyx* as having only capilliary chaetae. Bipalpate cirratulidae species from British waters have been placed in *Chaetozone* based on the presence of spines with unidentate tips.

Chaetozone setosa Malmgren, 1867
(Figs. 1A–L,3)

Chaetozone setosa Malmgren, 1867: 96, pl. 14, fig. 84; McIntosh, 1915: 264, pl. 107, fig. 4; Fauvel, 1927: 101, fig. 35 (in part); Wesenberg-Lund, 1950: 34; Christie, 1985: 241, fig. 2,4 (in part); Hartmann-Schröder, 1996: 394, fig. 189 (in part).

Material Examined.—Spitzbergen: Crossbay, 60 fa (= 108 m), coll. Malmgren, numerous syntypes, (SMNH 1495) one complete spec. measuring 18 × 1 mm for 80 chaetigers, is designated as the lectotype. Five spec. of which one measures 18 × 1 mm for 78 chaetigers are designated as paralectotypes. Two incomplete spec. of which one measures 8 × 1 mm for 64 chaetigers are designated as paralectotypes (NMSZ 1999.190); Kingsbay, 33 fa (= 59 m), coll. Malmgren, numerous syntypes (SMNH 1494) including a complete spec. measuring 13 × 0.8 mm for 60 chaetigers is designated a paralectotype. Two other incomplete spec. of which one meaures 8 × 1.5 mm for 50 chaetigers are designated as paralectotypes (NMSZ 1999.191); Green Harbour, 30 vi.1868, coll. Malmgren, several syntypes with eggs, (SMNH 3464) includes one complete spec. measuring 20 × 1 mm for 83 chaetigers is designated as a paralectotype. Two other complete spec. of which one measures 20 × 1 mm for 82 chaetigers are designated as paralectotypes (NMSZ 1999.192). North Sea: off Northumberland coast, St. P, 55°07'N 01°09.5′W, 80 m, 31.i.1992, muddy sand, coll. P.R. Garwood, several spec., of which one measures 9 × 1 mm for 77 chaetigers (NMSZ. 1998.118 and NMWZ. 1999.016.0003); off Northumberland coast, St M, 55°07′N 01°20′W, 55 m, 17.iii.1992, muddy sand, coll. P.R. Garwood, several spec. of which one measures 7 × 1 mm for 79 chaetigers (NMSZ, 1998.119 and NMWZ, 1999.016.0004). Northern North Sea: Veslefrikk oilfield, 60°50′N 02°50′E, 200 m, May 1990, fine mud, coll. ERT numerous spec., one measuring 12 × 1 mm for 79 chaetigers (NMSZ, 1998.120 and NMWZ, 1999.016.001). West Scotland, Irvine Bay, 55°35.92′N 04°47′W, 38 m, August 1992, soft mud, coll. M. O'Reilly SEPA, several spec. of which one measures 9 × 1 mm for 80 chaetigers (NMSZ, 1998.121 and NMWZ, 1999.016.002).

Description.—Most of the following is based on Malmgren's type specimens, except for descriptions of chaetae which are taken from several animals from Veslefrikk, as these needed to be dissected to allow a thorough examination.

Maximum body length 20 mm for 83 chaetigers. Body surface smooth, narrowly pointed anterior region, widens to mid-body area and then tapers to slightly narrower posterior region. Ventral surface flattened with a longitudinal groove. Anterior dorsal surface rounded, gradually flattening posteriorly. Segments narrow and crowded in anterior region, difficult to distinguish, becoming wider and more distinct in posterior region. Segment divisions in posterior 20 segments narrow, half the width of the segment, giving segment

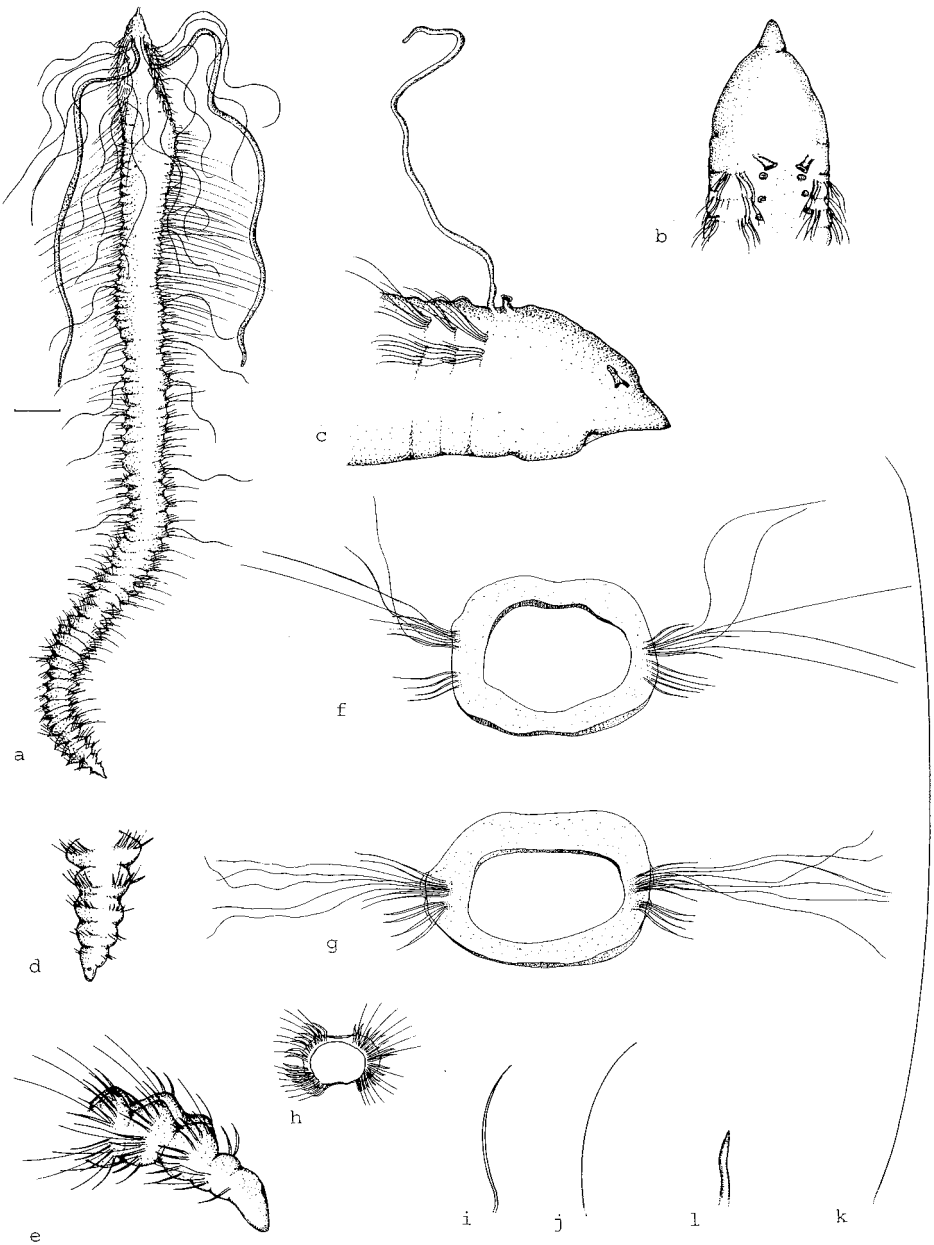

Figure 1. *Chaetozone setosa*: A, Whole animal in dorsal view, from Northumberland coast (NMSZ 1998.119); B, anterior end in dorsal view; C, anterior end in lateral view; D, posterior end in dorsal view; E, posterior end in lateral view (B-E paralectotype SMNH 1495 from Cross Bay); F, cross-section of 23rd segment; G, cross-section of 45th segment; H, cross-section of 65th segment; H, awl-shaped capilliary; J, fine capilliary; K, very long capilliary; L, unidentate spine. (F-L NMSZ 1998.120, Veslefrikk). Scale bar = 1 mm.

disc-shaped, closed 'concertina-like' appearance, (Figs. 1A,D). Color of material preserved in alcohol creamy white with iridescent sheen.

Prostomium conical with short acutely pointed tip and a pair of shallow nuchal grooves above the mouth, (Fig. 1C). No eyes. Peristomium achaetous, smooth, partially divided into three annuli, with a ventral mouth, pair of grooved tentacular palps originating from dorsal surface of posterior annulus (bases only present on lectotype) extending approximately half of the total body length (Figs. 1B,C). First pair of branchiae arising posterior to bases of tentacular palps, and extending approximately half of the total body length. Second pair of branchiae arising behind first pair of branchiae on first chaetigerous segment dorsal to notopodial lobes and extending a third of the body length. Branchiae present on every chaetiger in anterior region, occurring less regularly in mid-body region and absent on posterior third of body. All branchial filaments simple.

Parapodia all biramous with notopodial and neuropodial chaetae, parapodial lobes flattened ridges hardly extending from the body wall. Notopodial and neuropodial lobes very slightly separated in mid-lateral line with chaetae arranged in fan-shaped rows. (Figs. 1F,G,H). Chaetae curve posteriorly and laterally in anterior and mid-body and some project anteriorly in the posterior region.

Chaetae all simple, unidentate of four types: (1) awl-shaped capillaries in both notopodia and neuropodia on anterior and mid-body segments (Figs. 1I,3); (2) very long notopodial capillaries, 4–6 times longer than awl-shaped capillaries, 4–8 present from approximately 20–50th, 2–4 from 50–70th segment (Figs. 1K,3); (3) fine capillaries, approximately same length as awl-shaped capillaries, present in notopodia from approximately 50th segment and in neuropodia from approximately 40th segment (Figs. 1J,3); 4) spines, 1–2, in neuropodia from 40th segment; 6–8 spines alternating with fine capillaries in both notopodia and neuropodia from 50th chaetiger (Figs. 1L,3). Pygidium very small flat rounded ventral lobe, anal opening dorsal (Fig. 1D,E).

Remarks.—Christie (1985) described the reproductive biology of three populations of *C. setosa* from the Northumberland coast, northeast England. These included two intertidal populations at Low Newton by the Sea and Holy Island and one sub-littoral population at a site known as St. P. He noted and figured the variation in morphological characters of tentacular palps, and branchiae and in the type and arrangement of chaetae. The gametogenic and spawning data revealed three distinct populations with different development rates and spawning periods as well as differences in size and color of gametocytes. Christie concluded he had three distinct populations based on reproductive biology data, but he did not separate the taxa into three species. After examination of samples collected from the sub-littoral site, St. P. they have been re-identified as *C. setosa*.

Distribution and Habitat.—C. setosa is known from the Arctic, North Sea and west coast of Scotland, from sub-littoral sites in 38–200 m, from muddy sediments with a high silt/clay content. Specimens from other areas have not been examined consequently the geographical distribution cannot be confirmed. All records will need to be re-examined.

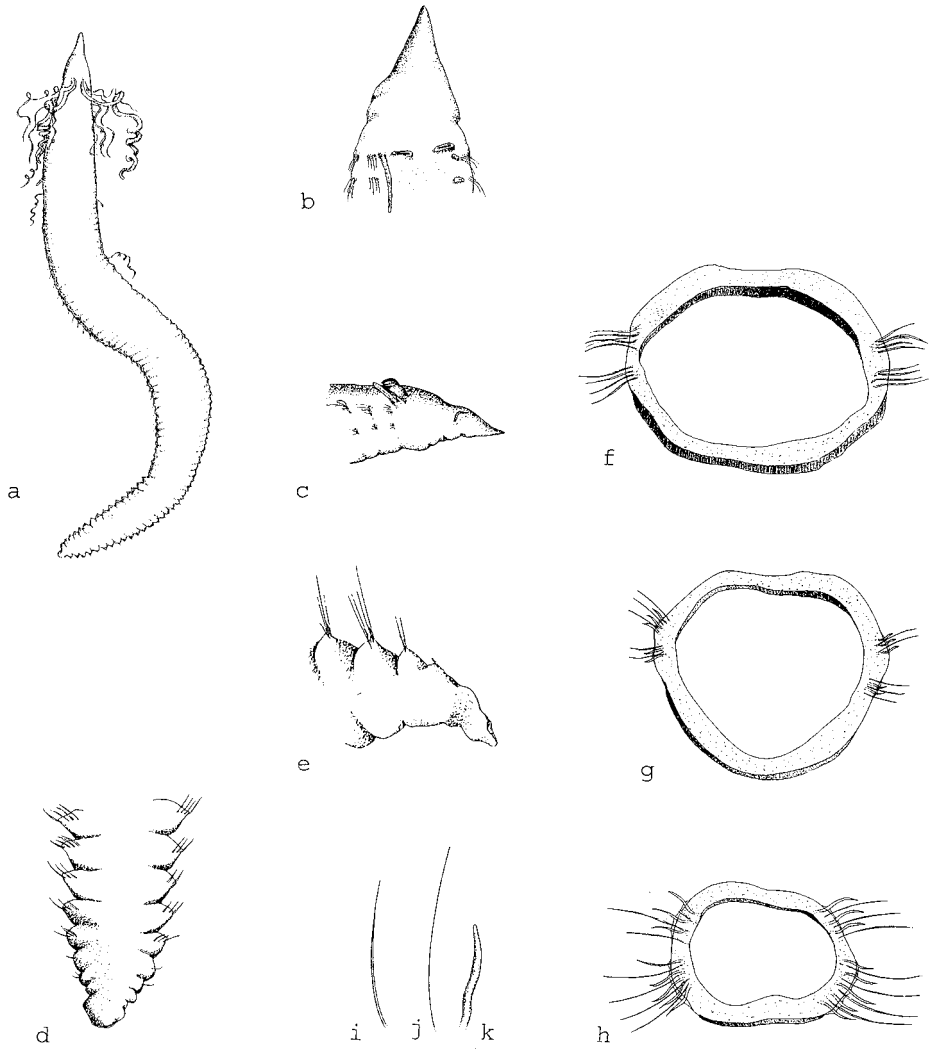

Figure 2. *Chaetozone christiei* n. sp. A, Whole animal in dorsal view, from Low Newton by the Sea Holotype (NMSZ 1998.122); B, anterior end in dorsal view; C, anterior end in lateral view; D, posterior end in dorsal view; E, posterior end in lateral view; F, cross-section of 17th segment; G, cross-section of 35th segment; H, cross-section of posterior segment; I, awl-shaped capilliary; J, fine capilliary; K, unidentate spine (B-K paratype from Low Newton by the Sea NMSZ 1998123). Scale bar = 1 mm.

Chaetozone christiei new species
(Figs. 2 A–K,3)

Chaetozone setosa Christie, 1985: 242, fig. 4c (in part).

Material Examined.—North Sea: Northumberland coast, Low Newton by the Sea 55°32′N 0.1°36′W, low shore, 3.xi.1982, clean sand, coll. P. R. Garwood, spec. measures

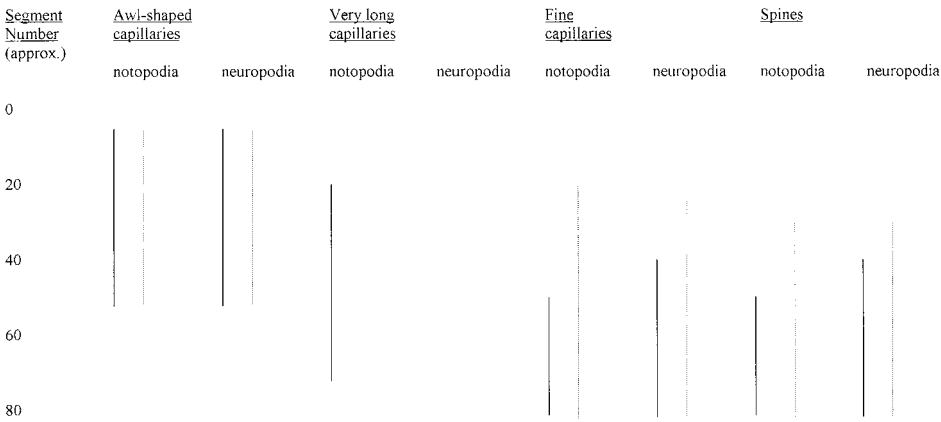

Figure 3**.** Table to show the arrangement of chaetae in *Chaetozone setosa* (solid line) and *christiei* n.sp. (dotted line).

6 × 1 mm for 75 chaetigers and is here designated as the holotype (NMSZ, 1998.122). Seven other spec. are designated as paratypes, one measuring 6 × 1 mm for 65 chaetigers; (NMSZ 1998.123 and NMW, 1999.016.006); Northumberland coast, Lloyd′s Hailing, 55°0.5′N 01°26′W, 0–10 m, 1992, numerous spec. of which one measures 18 × 0.5 mm for 80 chaetigers (NMSZ, 1998.124). English Channel: Southampton Water, Stanswood Beach, 50°48′N 01°19′W, low shore, 25.5.1993, clean sand, coll. R. N. Bamber, numerous spec. of which one measures 12 × 1 mm for 110 chaetigers.(NMSZ, 1998.125). West Scotland: Ayrshire coast, Ayr Bay, 55°28′N 4°40′W 10 m, August 1995, coll. M. O'Reilly, numerous spec. of which one measures 7 × 1 mm for 80 chaetigers (NMSZ, 1998.126 and NMWZ, 1999.016.0007).

Description.—Largely based on the holotype (NMSZ, 1998.122) and other material from the type locality.

Maximum body length 12 mm for 110 chaetigers. Body surface smooth, narrowly pointed anterior region widens to mid-body and posterior region. Ventral surface flattened with a longitudinal groove. Anterior dorsal surface rounded, gradually flattening posteriorly. Segments narrow and crowded in anterior region, difficult to distinguish, becoming wider and more obvious in posterior region. Segment divisions in posterior 30 segments slightly narrow 4-5ths width of segment, to give stretched 'concertina-like' appearance (Fig. 2A,D). Color of material preserved in alcohol creamy white with iridescent sheen.

Prostomium conical with long acutely pointed tip and a pair of shallow nuchal grooves above the mouth (Fig. 2C). No eyes. Peristomium achaetous, smooth, partially divided into three annuli, with a ventral mouth, pair of grooved tentacular palps originating from dorsal surface of posterior annulus extending approximately a third of the total body length (Fig. 2B,C). The first pair of branchiae arising on the first chaetiger and only slightly posterior and lateral to the bases of the tentacular palps, and extending approximately a third of the body length. Second pair of branchiae arising behind first pair of branchiae on second chaetiger and dorsal to notopodial lobes. Branchiae occurring on every chaetiger in anterior region, occurring less regularly in mid-body region and absent posteriorly from approximately 40th segment. Branchial filaments simple.

Parapodia all biramous with notopodial and neuropodial chaetae, parapodial lobes flattened ridges hardly extending from the body wall. Notopodial and neuropodial lobes separated in mid-lateral line with chaetae arranged in a single fan-shaped row (Fig. 2F,G,H). Chaetae directed posteriorly and laterally in anterior and mid-body region and both anteriorly and posteriorly in the posterior region.

Chaetae all simple, unidentate of three types: (1) awl-shaped capillaries in both notopodia and neuropodia on anterior body region to approximately 50th segment; (Figs. 2I,3); (2) fine capillaries, 2–3 times longer than awl-shaped capillaries, 3–4 present in notopodia and neuropodia from approximately 20th chaetiger to end of body; (Figs. 2J,3); (3) spines, 2–3 present in notopodia and neuropodia from 30th segment; 4–5 spines alternating with capillaries in notopodia and neuropodia in posterior body from approximately 50th segment (Figs. 2K,3). Pygidium rounded flattened leaf-like lobe, anal opening dorsal (Fig. 2D,E).

Distribution and Habitat.—*C. christiei* in British waters is known from the Northumberland coast and English Channel. It has been found intertidally and in shallow sub-littoral habitats in clean stable sand.

Etymology.—This species is named after G. Christie who studied the reproductive biology of this genus.

Remarks.—The reproductive biology data and morphological data collected by Christie (1985) indicated differences in two intertidal populations. The samples from Low Newton by the Sea have been examined and have characters and a reproductive pattern that separate them from *C. setosa*. Specimens from Holy Island have also been examined, but more samples from other localities are required before they can be adequately described.

Discussion.—Observations of other Cirratulidae material in the North Sea suggests there are several species of *Chaetozone* and at least two undescribed taxa. They all have spines with unidentate tips, and the positions of the tentacular palps and branchiae relative to the first chaetiger varies. Therefore all records of *C. setosa* will need to be re-examined.

When more material is made available from a range of localities the true status of *Chaetozone* species may be determined. Until then it is considered inappropriate to produce a dichotomous key as this would lead to further confusion.

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